New claims

1. A process for the production of light-diffracting microstructures (13) in a layer (2) of photoresist on a substrate (1), which are produced by superimpositions of a first relief structure (5) with at least one second relief structure serving as a diffraction structure (12),

characterised by the steps

a) producing a layer (2) of photoresist with a first relief structure (5) on a flat substrate (1), which is produced by forming the shape of a relief die (4) disposed in opposite relationship to the substrate (1), into the free surface of the layer (2),

b) removing the relief die (4),

c) producing an interference pattern on the relief structure (5), wherein coherent light is divided into a partial beam (9) and a reference beam (10) and the partial beam (9) and the reference beam (10) are caused to interfere including a predetermined intersection angle on the shaped first relief structure (5),

d) orienting the interference pattern which includes fringes of a high level of light intensity separated by fringes of a low level of light intensity in respect of azimuth in relation to the first relief structure (5) by rotation of the substrate (1) about a normal (15) to the plane of the substrate (1),

e) exposing the first relief structure (5) in the photoresist layer (2) by means of the interference pattern during a predetermined time,

f) developing the photoresist during a predetermined time, wherein material of the photoresist which was changed during the exposure operation is partially removed and grooves (13) of the diffraction structure (12) are produced in the first relief structure (5), and

g) drying the photoresist.

2. A process as set forth in claim 1 characterised in that in step f) the time for development of the photoresist is such that the grooves (13) of the

diffraction structure reach a depth of at most 500 nm, preferably at most 250 nm.

3. A process as set forth in claim 1 or claim 2 characterised in that in step a) firstly the photoresist layer (2) is produced on the flat substrate (1), solidified by the action of heat and then the relief die (4) mounted on a stamping punch (3) is lowered into the surface of the photoresist layer (2) so that the shape of the first relief structure (5) is produced as a negative of the relief die (4).

4 A process as set forth in claim 1 or claim 2 characterised in that in step a) the layer (2) is produced by casting, wherein the liquid photoresist is cast between the substrate (1) and a relief die (4) and that after solidification of the photoresist under the effect of heat and removal from the mold the free surface of the layer (2) has the first relief structure (5) as a negative of the relief die (4).

5. A process as set forth in one of claims 1 through 4 characterised in that in step a) a periodic grating is shaped in the photoresist layer (2) as the first relief structure (5).

6. A process as set forth in one of claims 1 through 4 characterised in that in step a) a cross grating is shaped in the photoresist layer (2) as the first relief structure (5).

7. A process as set forth in one of claims 1 through 6 characterised in that in step a) a periodic grating is shaped in the photoresist layer (2) with a spatial frequency in the region of between 1 line/mm and 1000 lines/mm as the first relief structure (5).

8. A process as set forth in claim 5 or claim 6 characterised in that in step b) the intersection angle between the partial beam (9) and the reference beam (10) is so set that the diffraction structure (12) produced is

a grating having a spatial frequency which corresponds at least to five times the spatial frequency of the relief structure (5).

9. A process as set forth in one of claims 1 through 4 characterised in that in step a) one of the light-scattering matt structures is shaped into the photoresist layer (2) as the first relief structure (5).

10. A process as set forth in one of claims 1 through 4 characterised in that in step a) a relief die (4) with a structure with at least one paraboloid surface (16) and/or a cone tip (17) is used for producing the shape of the first relief structure (5).

11. A process as set forth in one of claims 1 through 10 characterised in that the relief structure (5) is shaped with a structural depth (T) in the region of between 0.1 μm and 100 μm.

12. A process as set forth in one of claims 1 through 11 characterised in that prior to execution of step g) the photostructuring is repeated with at least one further diffraction structure (12) with the steps c) through f), wherein in step d) the first relief structure (5) with the grooves (13) of the diffraction structure (12) is oriented in relation to a new interference pattern by rotation of the substrate (1) about the normal (15).

13. A process as set forth in claim 12 characterised in that upon repetition of the photostructuring operation in step b) the intersection angle between the partial beam (9) and the reference beam (10) is changed.

14. A process as set forth in one of claims 1 through 13 characterised in that in step b) the intersection angle between the partial beam (9) and the reference beam (10) is so set that the diffraction structure (12) is produced with a grating period of at most 500 nm.